

States. At points in northern California it was among the driest Decembers of record, and that State as a whole was unusually dry.

In Florida the precipitation was usually deficient to a considerable extent, particularly in the southern portions where drought, more or less severe, had prevailed since the second decade of October. At Miami, the total precipitation from October 21 to December 31 amounted to only 9 per cent of the normal for the period. This lack of precipitation, however, was beneficial rather than harmful in portions of the Everglades, permitting the low ground to dry out sufficiently for truckers to begin operations.

SNOWFALL.

The snowfall was almost as great as in any previous December over New Mexico, principally owing to the vigorous snowstorm which reached most of that State and considerable parts of adjoining States about the 10th. This snow blocked railway and highway traffic on most of the important roads. A few of the higher portions of the Northwest and part of the upper Mississippi Valley had somewhat more snowfall than the December average.

On the whole, the country had considerably less snow than usually comes at this season, and this was notably true of California and Nevada and of the States just north of the Ohio River. The Lake region and the

Northeast, which are the snowiest districts of the eastern half, had less than normal, as did the northern Plains, and in these areas, as well as in the upper Mississippi Valley, most of the snow that occurred was during the final week. In the northwestern districts also the greater part of the snow came between Christmas and New Year's Day. As a result of these falls late in the month, the depth on ground when the month ended was not far from the average December condition in most portions of the country, but there was a serious shortage in the California mountains and most of the ground was bare from Illinois eastward to New Jersey and southeastern New York.

Chart VII indicates the distribution of the month's snowfall, and the inset chart shows the depths that remained on the 31st.

RELATIVE HUMIDITY.

Over most portions of California and in the adjacent parts of Nevada the general dryness of the month is indicated by the average relative humidity, which ranged from 5 to nearly 20 per cent less than normal. In Arizona, however, and thence eastward over the Gulf and South Atlantic States the relative humidity was everywhere above normal, and decidedly so in the more western portions. In other districts the relative humidity was not materially at variance with normal conditions.

SEVERE LOCAL STORMS, DECEMBER, 1923.

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the annual report of the Chief of Bureau.]

| Place. | Date. | Time. | Width of path. | Loss of life. | Value of property destroyed. | Character of storm. | Remarks. | Authority. |
|---|-------|-------|----------------|---------------|------------------------------|---|---|--|
| Puget Sound, Wash. (near Friday Harbor). Oregon coast..... | 5 | P. m. | Yards. | | | Gale..... | Steamer foundered and crew of 15 believed lost. | Star (Seattle, Wash.). |
| Northern Idaho and north-eastern Washington. Binghamton, N. Y..... | 5-6 | | | | | Wind and rain.... | Considerable property damage. Communication and traffic interrupted. | Telegram (Portland, Oreg.). |
| | 5-6 | | | | | Wind, rain, and snow. | Telephone poles and trees blown down; traffic tied up and many towns isolated. | Chronicle (Spokane, Wash.). |
| | 6 | | | | | Wind..... | Limbs blown from trees, electric light poles, windows, and globes broken; other property damage. | Press (Binghamton, N. Y.). |
| New Mexico (greater portion of). | 10-11 | | | 14 | \$200,000 | Heavy snow storm followed by severe cold. | Some livestock lost and traffic tied up. A number of persons were frozen to death. | Official, U. S. Weather Bureau. |
| Coos Bay, Oreg..... | 16 | | | 9 | | Wind..... | Steamer wrecked..... | Roseburg News Review (Oregon). |
| Washington and Oregon coasts. | 25 | | | | | High winds..... | Considerable damage to roofs, plate-glass windows, telephones, wires and poles. Shipping delayed. | Official, U. S. Weather Bureau Bulletin (San Francisco, Calif.). |

STORM AND WEATHER WARNINGS.

WASHINGTON FORECAST DISTRICT.

Storm warnings were issued in connection with five storms for the Middle Atlantic and North Atlantic coast and all were fully verified, except the warnings issued on the night of the 30th. The first warnings of the month were displayed the night of the 4th, at which time a disturbance of considerable intensity was central over Kentucky and moving northeastward. This storm moved very slowly during the ensuing 36 hours, but it increased in both area and intensity. There were gales along the entire seaboard from Cape Hatteras northward, and the highest velocity reported was 60 miles an hour from the southeast at Atlantic City, N. J.

The next storm of importance to cross the country was central over northern Ontario on the morning of the 13th,

and a trough of low pressure extended thence southward to the Gulf coast. Southwest storm warnings were ordered displayed at all stations from Cape Hatteras northward and gales were general during the afternoon and night of the 13th. A maximum wind of 60 miles an hour from the south occurred at Atlantic City, N. J., and the same velocity from the north at Cape Henry, Va.

The next warnings were issued for the coast from Delaware Breakwater northward in connection with a disturbance that moved rapidly eastward from Ontario to Nova Scotia during the 16th-17th. The highest wind velocity reported was 56 miles an hour from the northwest at Block Island, R. I.

A disturbance that was central over Iowa on the morning of the 27th moved rapidly east-northeastward to Nova Scotia and Newfoundland during the next two days. It increased greatly in intensity and was attended by gales almost generally along the coast from Wil-

ington, N. C., northward, the highest velocity being 68 miles an hour from the northwest at New York City. Warnings were displayed well in advance of this storm.

The last storm warnings of the month were displayed from Cape Hatteras northward in advance of the disturbance that was central over Illinois the evening of the 30th and moved northeastward with increasing intensity over the southern Lake region and the St. Lawrence valley. The maximum wind velocity reported was 56 miles an hour from the northwest at New York City.

Cold wave warnings.—December was an unusually mild month in the Washington Forecast District. No cold-wave warnings were issued, except for portions of northern New England and northern New York, until near the close of the month. Warnings were issued for practically the entire district, except southern and central Florida and the Atlantic States north of Maryland during the last two days of the month, well in advance of the cold wave that swept rapidly southeastward from the Canadian Northwest over the Plains States and the Missouri and upper Mississippi valleys. However, the cold wave lost much of its intensity in the sections farther east and south and the warnings were fully verified only in Kentucky, Tennessee, and the interior of the east Gulf States.

Frost warnings were issued for portions of the South Atlantic and east Gulf coasts and Florida on the 5th, 6th, 13th, 14th, 16th, 23d, 24th, and 25th.—*Chas. L. Mitchell.*

CHICAGO FORECAST DISTRICT.

The month was warm throughout practically the entire forecast district, and precipitation was deficient, except in the Ohio Valley. There was very little snowfall, except in the northern and eastern portions of the Great Lakes region.

Cold wave warnings.—The only cold wave of the entire month pushed southeastward from Alaska to the Canadian Northwest Provinces by December 28, and this steadily moved southward and eastward over the entire Chicago district. Warnings were issued from one to three days in advance of the area of low temperature. The cold wave finally culminated in the first week of January in a period of lowest minima registered within a decade or more at many points.

Livestock warnings.—Livestock warnings were issued for the western ranges during the closing week of the month in advance of the severe cold wave, and press dispatches indicate that, because of these warnings, all exposed cattle were driven to points of shelter.

Storm warnings.—The storm-warning season terminated on December 15 on Lake Superior and on December 18 on the balance of the Great Lakes. Until the close of the season the Great Lakes were exceptionally free from storms of great violence. Warnings were issued for four different storms, with advices for strong winds, as the disturbances moved across the Great Lakes, and so far as known no loss was experienced by vessel interests.

Following the formal close of navigation, winter service was maintained upon Lake Michigan. The storm which ushered in the cold wave at the close of the month was accompanied by strong winds, and advices well in advance were sent to the open ports on the Lake.

Warnings to banana shippers.—A special warning service as an aid to the protection of bananas in transit was begun during the month, and advices were sent to selected points in the Middle West whenever warranted by conditions.

Special forecasts.—We were requested by Mr. S. B. Fracker, State entomologist, Department of Agriculture,

Madison, Wis., to issue a special forecast for certain points in Wisconsin whenever a temperature of minus 10° or lower was expected, for use in connection with tests being made with weevil-infested alfalfa. Special forecasts were sent on two dates, December 29 and 31, and apparently were highly satisfactory, as shown by the following excerpt from letter received from the Wisconsin Department of Agriculture:

I wish to thank you for the telegrams regarding low temperatures received from your office, signed by Mr. Donnel. They were of great value, as they enabled us to get in touch with the owners of the supposedly infested alfalfa and arrange for the exposure of the hay.

—*H. J. Cox.*

NEW ORLEANS FORECAST DISTRICT.

Severe weather conditions were lacking except on December 30 to January 1, when an area of high pressure moved southward behind an east-west trough, dividing the trough after causing it to assume a crescent shape. Unusually cold weather resulted in the interior sections and a "norther" on the Texas coast. Cold-wave warnings were issued well in advance of the low temperatures attending this anticyclone and were verified except in the coast sections of Louisiana and in the vicinity of El Paso, Tex. Northwest storm warnings were displayed on the 31st for strong northerly winds on the Texas and Louisiana coasts and moderate to fresh gales on the Texas coast. Winds occurred as forecast on the Texas and western Louisiana coasts but were weaker on the eastern Louisiana coast, as the pressure gradient diminished with eastward movement of the high pressure.

Small-craft warnings, displayed on the Texas coast on the 7th and 13th, were justified. "Norther" warnings were issued for Tampico, Mexico, on the 13th and 31st.

Frost or low-temperature warnings were issued for portions of the district on the 4th, 5th, 6th, 10th, 13th, 14th, 16th, 23d, and 24th, and were verified except where cloudiness prevented frost in the extreme southern sections on the 17th, 24th, and 25th.

Warnings were issued on the 10th, 29th, 30th, and 31st for livestock interests in portions of the district and were justified. A blizzard developed in West Texas on the 10th and continued into the 11th, with temperatures well below freezing in the northern and western portions. Fire-weather warnings were issued on the 7th for forested areas in Arkansas, Oklahoma, and Texas, and were also justified.—*R. A. Dyke.*

DENVER FORECAST DISTRICT.

On the 7th, when a LOW of unusual energy moved from Alberta to the northwestern portion of the Lake region, a secondary storm of great intensity developed over southeastern Wyoming and eastern Colorado, the center of which advanced southwestward to northeastern Arizona by the morning of the 8th and thence southward to Texas by the night of the 8th–9th. On the morning of the 8th, warnings of a moderate cold wave were issued for southwestern Colorado and extreme northwestern New Mexico "to-night" and for southeastern New Mexico the following day, Sunday, together with livestock warnings for southwestern Colorado and northwestern New Mexico. Warnings of a moderate cold wave in southeastern New Mexico were repeated at 8 p. m. of the 8th.

The cold-wave warning was fully verified in southwestern Colorado and northwestern New Mexico. While